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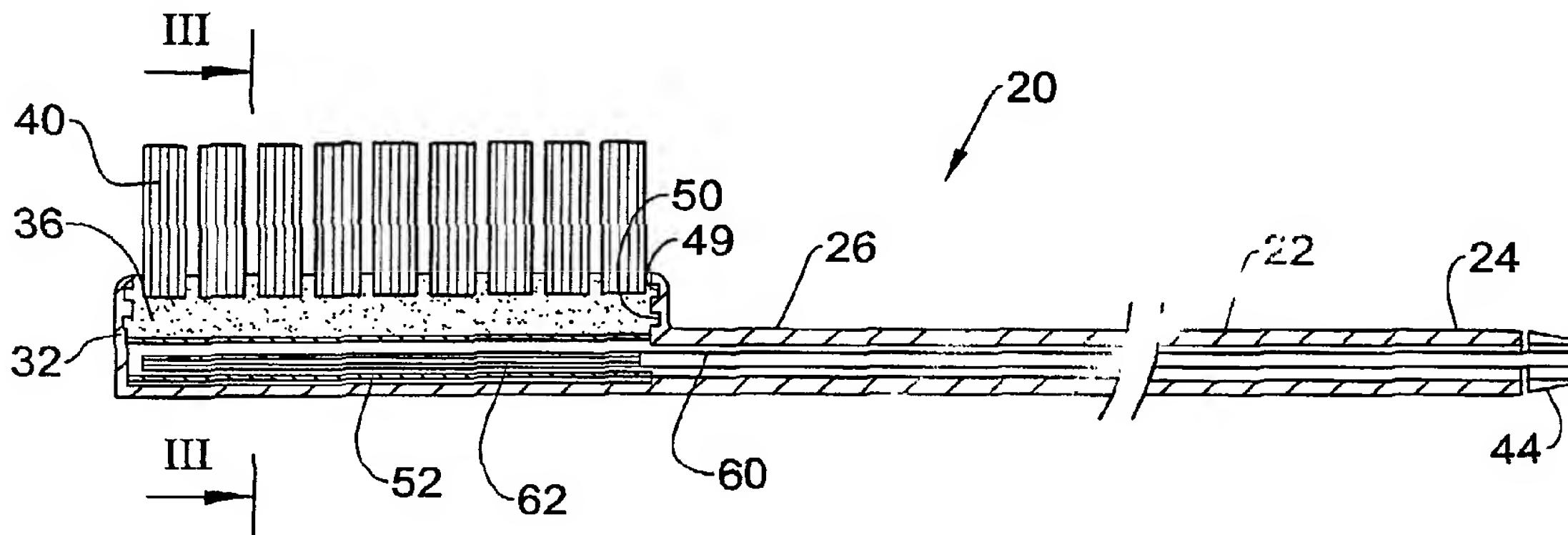
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(54) Title: IMPROVED TOOTHBRUSH



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(57) Abstract: A toothbrush comprising an elongate handle and a head portion fixed at an end of the handle and comprising a rigid frame member supporting a bristle tuft bed fitted with a plurality of bristle tufts. The bristle tuft bed is deformable about a longitudinal axis between at least a first, essentially flat position wherein the bristle tuft arrays extend essentially parallel to one another, and a second position in which the bristle tuft bed is concave whereby the bristle tufts diverge. A manipulating mechanism is provided for deforming the bristle tuft bed to acquire any of the positions.

## IMPROVED TOOTHBRUSH

### FIELD OF THE INVENTION

The present invention is generally in the field of toothbrushes and more specifically it is concerned with an improved toothbrush in which the toughness of the bristles and the effective brushing area are controllable by the user.

### 5 BACKGROUND OF THE INVENTION AND PRIOR ART

In order to brush an individual's teeth in a satisfying manner, it is required that during displacement of the toothbrush head about the teeth, the bristles reach all surfaces of the teeth and also penetrate into inter-teeth clearance. Apart from its cleaning effect, a tooth-brushing procedure also plays a great role in mouth hygiene 10 in that it massages the gums.

For the above reasons, a large variety of toothbrushes are provided, most of which being concerned with improving accessibility and engagement of the bristles with surfaces of the teeth by means such as flexible toothbrushes or toothbrush head portions, flexibly mounted bristle tufts, etc. Other mechanisms are concerned 15 with converting linear motion in one direction (typically a lateral stroke) into motion in another direction, e.g. rotary motion or linear motion in one or more other directions, etc.

It is common that individuals apply excessive force during brushing. This provides an alleged feeling of improved brushing as well as a pleasant feeling 20 owing to the increased massaging effects. However, it is today well appreciated that excessive brushing pressure may result in damage to teeth and gums which at times is irreversible.

Several patents are concerned with providing a toothbrush with a flexible handle or head, so as to improve positioning and orientation of the bristles to the unique profile of an individual's mouth and the brushing characteristics of an individual. However, all these patents suffer from a common drawback, namely, the 5 toughness of the bristles remains constant and it is quite an impossible mission to educate individuals to alter brushing pressure at different zones in the mouth.

U.S. Patent No. 2,819,482 is concerned with a toothbrush adapted for cleaning and massaging the mucous membrane of the mouth approximating the gingival portion of the teeth, namely, the gums. The toothbrush in accordance with 10 that invention comprises a plurality of bristles embedded within a body of resilient material leaving only the ends of the bristles exposed for a short distance.

U.S. Patent No. 5,774,923 discloses a toothbrush fitted with a flexibly linked zone at its head whereby the head is capable of floating relative to the handle thus obtaining a gentle brushing action and reducing the likelihood of injury to the 15 gums of the user.

U.S. Patent No. 5,839,149 discloses a flexible member formed for resilient flexure between an essentially flat shape and a concave shape for improving contact of the bristles with the teeth's surfaces.

U.S. Patent No. 5,528,786 is directed to a toothbrush in which reciprocal displacement along the longitudinal axis of the toothbrush entails reciprocal swinging displacement of the bristle tufts along an axis perpendicular to said longitudinal axis. This reciprocal swinging motion entails widening and narrowing the span of the bristles though it may not be retained at a fixed span.

It is an object of the present invention to provide a novel and improved 25 toothbrush wherein the toughness of the bristles as well as the effective brushing width may be personally adjusted to suit the individual's requirements and the individual's mouth condition.

## SUMMARY OF THE INVENTION

The present invention calls for a toothbrush in which stiffness of the bristle tufts may be personally adjusted by a manipulator of the toothbrush, whereby an individual may use the toothbrush either as a so-called *soft toothbrush* or a *hard toothbrush* or at one or more intermediate positions, depending on personal preferences and on specific conditions of the individual's mouth hygiene. Furthermore, the individual controls the effective brushing width of the toothbrush.

By referring to bristle toughness or stiffness, it is obviously not intended to change mechanical properties of the bristles but rather to impart the bristles different degrees of stiffness namely, increasing or reducing their resistance to pressure. This is obtained by converging the bristle tufts towards one another so that they conjoin at their free ends and can then withstand higher pressure whereby their stiffness is increased. Decreasing the bristle stiffness is obtained in an opposite manner, i.e. by diverting the bristle tufts from one another.

The term *effective brushing width* refers to the span of the bristles, at their free ends.

In accordance with the present invention there is provided a toothbrush comprising an elongate handle and a head position fixed at an end of said handle and comprising a rigid frame member supporting a bristle tuft bed fitted with a plurality of bristle tufts; said bristle tuft bed being deformable about a longitudinal axis thereof between at least a first, essentially flat position wherein said bristle tuft arrays extend essentially parallel to one another and a second position in which the bristle tuft bed is concave whereby the bristle tufts diverge; and a manipulating mechanism for deforming said bristle tuft bed to acquire any of said positions. Preferably, the bristle tuft bed is deformable to assume also a third position in which it is convex whereby the bristle tufts converge.

In accordance with the present invention said manipulating mechanism is an eccentric mechanism fitted in the head portion and comprising a longitudinal actuator extending through a longitudinal axis of the toothbrush head with at least a portion thereof pivotally fixed to the head portion, with an eccentric mechanism

engageable with the bristle tuft bed for deforming it about said longitudinal axis. The eccentric mechanism may be selected out of various cam and follower mechanisms.

In accordance with an embodiment of the invention, the bristle tuft bed is 5 made of a resilient material wherein edges thereof are secured to respective edges of the frame member. By one particular design, the bristle tuft bed is articulated to an essentially rigid compartment dimensioned to accommodate the eccentric portion of the actuator.

An actuator of the manipulating mechanism may be a rotatable member or a 10 slidable member wherein a suitable mechanical converting mechanism is provided for converting linear motion into a rotary motion.

In accordance with one particular embodiment of the invention the manipulating mechanism is fixable at different positions so as to retain the bristle tuft bed at any respective position and prevent it spontaneously departing from said 15 position.

## BRIEF DESCRIPTION OF THE DRAWINGS

In order to understand the invention and to see how it may be carried out in practice, some embodiments will now be described, by way of some non-limiting examples only, with reference to the accompanying drawings, in which:

20 **Fig. 1** is an isometric view of a toothbrush in accordance with the present invention the bristle tufts disposed at an essential parallel position;

**Fig. 2** is a longitudinal section along line II-II in Fig. 1;

**Fig. 3** is a sectional view taken along line III-III in Fig. 2;

25 **Fig. 3A** is an embodiment of the toothbrush head in a position corresponding with that of Fig. 3;

**Fig. 4** illustrates the toothbrush of according to the invention with the bristle tufts in a converged position to assume a less stiff bristle tuftness;

**Fig. 5** is a longitudinal section through line IV-IV in Fig. 2;

**Fig. 6** is a sectional view along line VI-VI in Fig. 5;

– 5 –

**Fig. 6A** is an embodiment of the toothbrush head in a position corresponding with that of Fig. 6;

**Fig. 7** illustrates the toothbrush according to the invention in a position at which the bristle tufts converge to obtain increased bristle stiffness;

5 **Fig. 8** is a section view along line VIII-VIII in Fig. 7;

**Fig. 8A** is an embodiment of the toothbrush head in a position corresponding with that of Fig. 8;

10 **Fig. 9** is an isometric view of a toothbrush in accordance with the present invention illustrating an actuating member in accordance with an embodiment of the invention; and

**Fig. 10** illustrates a toothbrush in accordance with the present invention with still another type of actuator.

## DETAILED DESCRIPTION OF THE INVENTION

Attention is first directed to Fig. 1 of the drawings illustrating a toothbrush 15 in accordance with the present invention generally designated 20, comprising an elongate handle 22 extending between a proximal end 24 and a distal end 26, and a head portion generally designated 30 integrally fitted at said distal end 26.

Head 30 comprises a rigid frame member 32 made of plastic, fitted with a bristle tuft bed 36 made of resilient material, e.g. a rubber film, a layer of silicon 20 rubber, etc. A plurality of bristle tufts 40 are fixedly received within the bristle tuft bed 36, typically in an array of parallel rows, three in the present example. However, other arrangements are possible, as known *per se*.

Further noticed in Fig. 1 the toothbrush 20 is fitted at the proximal end 24 of the handle 22 with a control member 44, rotatable along a longitudinal axis of the 25 toothbrush as will be explained hereinafter. Toothbrush 20 has the general appearance of a regular toothbrush, with the addition of control member 44.

With further reference made also to Figs. 2 and 3, it is noted that the bristle tuft bed 36 is molded into the frame member 32 which comprises a plurality of indentations or apertures 49 and 50 to improve engagement of the bristle tuft bed 36

within the frame member 32 and to prevent unintentional disengagement therefrom. It is important that the bristle tuft bed 36 is secured at its peripheral portions to corresponding peripheral portions of the rigid frame 32. In the preferred embodiment, bristle tuft bed 36 is flush with a top surface 39 of the frame (Fig. 3).

5 Bristle tuft bed 36 is positioned over a rigid compartment 52, best seen in Fig. 3 having a rectangular cross-section and extending essentially along the cavity within the toothbrush head 30. The compartment 52 is formed, in the present embodiment, with a pair of lateral projections 54 formed with a plurality of apertures 56 whereby the compartment 52 may be articulated to the bristle tuft bed 36 by molding the bristle tuft bed thereover and allowing molten material to 10 penetrate into the apertures 56, improving articulation thereto. Lateral projections 54 prevent lateral displacement of the compartment 52 within the toothbrush frame 32.

It is appreciated that the compartment 52 is not integral with the rigid frame 15 member 32 and may be vertically displaceable (i.e. in a direction parallel with a longitudinal axis of the bristle tufts. Lateral projections 54 prevent lateral displacement of the compartment 52 within the frame 32.

Extending through the compartment 52 there is an actuator 60 in the form of an elongate rod extending also through the handle 22 and terminating at the 20 actuator control member 44. As can best be seen in Fig. 3, the distal end of actuator 60 is notably coupled within an aperture of frame 32. The activator 60 comprises an eccentric portion 62 which in this figure is illustrated at a lateral position which is referred to as a so-called *rest* position of the toothbrush. Actuating member 60 may be rotated clockwise or anti-clockwise by means of 25 actuating control member 44 or by other means, as will be explained in accordance with several examples hereinafter.

It is thus apparent that rotation of the actuator 60 with the eccentric portion 62 entails vertical displacement of the compartment 52 within the toothbrush head 30, depending on the angular position of the eccentric portion 62 30 namely, the compartment 52 displaces downwardly when the eccentric portion 62 is

at an essentially vertical position facing downwards (Fig. 8) and in its uppermost position when the eccentric portion 62 of actuator 60 is in its vertical, upward position (Fig. 6). Obviously, vertical displacement of the compartment 52 entails corresponding deformation of the bristle tuft bed 36, the outcome of which will 5 become apparent hereinafter.

The toothbrush 20, in its position illustrated in Figs. 1 to 3, has the bristles extending essentially parallel to one another whereby the toughness of the bristles is referred to as the normal or nominal hardness of the toothbrush as referred to in a regular toothbrush, i.e., soft, hard, medium, etc. This hardness is dictated first of all 10 by the mechanical properties of the bristles depending on the material they are made from and its characteristics, and also by the packing of the bristle tufts and their seating media.

With further reference to Figs. 4 to 6, the toothbrush 20 is illustrated in a position wherein the actuating control member 44 has been rotated in a counter 15 clockwise direction, i.e., in the direction of arrow 70 in Fig. 4. Rotation of actuating control member 44 entails a corresponding rotation of actuator 60 and the eccentric portion 62 (see Fig. 6), resulting in ascending of the rectangular receptacle 52 within the toothbrush head frame 32, causing the bristle tuft bed 36 to deform into a concave position and thus causing the rows of bristle tufts to diverge, i.e., angularly 20 depart from one another, as can best be seen in Figs. 4 and 5.

In this position, where the bristle tufts, in particular the free ends, are remote from one another, their overall toughness decreases as each bristle tuft stands alone and is not supported by neighboring bristle tufts. This renders the hardness of the bristle tufts to be referred to as *soft*.

25 It is appreciated that by further rotating the actuating control member 44 in a counter clockwise direction as indicated by arrow 70 in Fig. 4, the toothbrush will assume the position of Fig. 1 wherein the bristle tufts are essentially parallel to one another.

However, further rotation of actuating knob 44 in the direction of arrow 70 30 or, rotating it by 90° in a counter clockwise direction (from its initial position),

entails the receptacle 52 to descend to a lowermost position whereby the associated bristle tuft bed 36 is forced to deform into the position of Fig. 8, obtaining a convex shape, resulting in the bristle tufts to converge into the position of Figs. 7 and 8 where the bristle tufts bear against one another rendering them increased toughness 5 as they become supported by one another. In this position the hardness of the bristle tufts may be referred to as *hard*.

The respective positions of Figs. 3, 6 and 8 illustrate the eccentric portion 62 at extreme positions wherein geometric locking is possible against the receptacle 52. However, suitable arresting means may be provided (not shown) for 10 arresting the eccentric portion 62 at any position or intermediate position so as to obtain a desired toughness of the bristles. Such arresting means may be, for example, forming the inner surface of the receptacle 52 with indentions for arresting the eccentric portion 62 or, forming the actuating knob 44 and a corresponding surface at the proximal end of handle 22 with bulges and indentions 15 for snapping engagement so as to arrest the actuating knob 44 at any respective desired position.

Furthermore, it may be advantageous to provide some indicia means so as to 20 position of the actuating mechanism or rather of the bristle tufts. By providing such indicia, the toothbrush may be easily adjusted for use by an individual at the different conditions as may be desired.

In the embodiment represented in Figs. 3, 6 and 8 frame 32 of the toothbrush head 30 is formed with a bottom wall 33, whereby upon activating the toothbrush into the position of Fig. 8 the resilient material of the bristle tuft bed is not exposed in will not project below a bottom edge of the head. However, in Figs 25 3A, 6A and 8A, there is illustrated a modification of the invention and for sake of clarity similar elements have been designated like reference numbers with a (') indication. In the embodiment of Figs. 3A, 6A and 8A, the frame 32' is devoid of a base wall and thus the bottom surface 35 of the resilient bed member 36' is visible as it deforms between its respective positions, i.e., flat, concave and convex,

receptively. Preferably, peripheral edges of the resilient bed 36' are attached to bottom edges of the frame 32' to prevent dirt from entering in between.

It is also appreciated that apart from changing the toughness/stiffness of the bristle tufts, changing the position of the toothbrush also changes the effective brushing area of the toothbrush between a standard position (Figs. 1 to 30, a wide position (Figs. 4 to 6), and a narrow position (Figs. 7 and 8). These receptive positions allow the user to adjust the brush to specific needs of the individual.

Whilst in the embodiments illustrated and described hereinabove, the toothbrush head is provided with a rigid receptacle 52, it may be omitted whereby the actuating member revolves in conjunction with the resilient bristle tuft bed. However, in this case, the bristle tufts have only two extreme positions, namely, a position in which the bristle tufts are essentially parallel (corresponding with the positioning illustrated in Figs. 1-3) and a position at which the bristle tufts diverge, (corresponding with the position of Figs. 4-6).

In accordance with another embodiment (not illustrated) the top surface 77 of the casing 52 (see Fig. 6) may be formed with a concave contour for better supporting the resilient bristle tuft bed 36.

Turning now to Fig. 9, there is illustrated a slightly different embodiment of the present invention wherein the actuating control member is in the form of a sliding actuator 79 axially displaceable along the longitudinal axis of the toothbrush 80 in the direction represented by arrow 81. In this case, there is provided a suitable converting mechanism (not seen) for converting linear motion along the longitudinal axis into rotary motion of said longitudinal axis.

In the embodiment of Fig. 10, the toothbrush 85 is fitted with a roller actuating member 86 which is revolvable either clockwise or counter clockwise in the directions of arrow 87. Roller 88 may be directly mounted over the axis of actuator 60 or may be linked thereto by suitable gearing.

Furthermore, in case of a toothbrush having a flexible connection between the handle and the head portion as known *per se*, there should be provided a

– 10 –

suitable flexible rotary transferring mechanism, e.g. a flexible wire or some other link, as known in the art.

Whilst some embodiments have been described and illustrated with reference to some drawings, the artisan will appreciate that many variations are  
5 possible which do not depart from the general scope of the invention, *mutatis mundantis*.

**CLAIMS:**

1. A toothbrush comprising an elongate handle and a head portion fixed at an end of said handle and comprising a rigid frame member supporting a bristle tuft bed fitted with a plurality of bristle tufts; said bristle tuft bed being deformable about a longitudinal axis thereof between at least a first, essentially flat position wherein said bristle tuft arrays extend essentially parallel to one another, and a second position in which the bristle tuft bed is concave whereby the bristle tufts diverge; and a manipulating mechanism for deforming said bristle tuft bed to acquire any of said positions.
- 10 2. A toothbrush according to Claim 1, wherein the bristle tuft bed is deformable also into a third position in which the bristle tuft bed is convex whereby the bristle tufts converge.
3. A toothbrush according to Claim 1, wherein said manipulating mechanism is an eccentric mechanism fitted in the head portion and comprising a longitudinal actuator extending through a longitudinal axis of the toothbrush head with at least a portion thereof pivotally fixed to the head portion, with an eccentric portion engageable with the bristle tuft bed for deforming it about said longitudinal axis.
4. A toothbrush according to Claim 3, wherein the actuator is received within an essentially rigid compartment associated with the bristle tuft bed and dimensioned so as to snugly accommodate the eccentric portion at said first and second positions.
- 20 5. A toothbrush according to Claim 1, wherein the manipulating mechanism is fixable so as to retain the bristle tuft bed at any respective position.
6. A toothbrush according to Claim 5, wherein the actuator is rotatably received within an essentially rigid compartment associated with the bristle tuft bed and whereby the eccentric portion is rotatably arrested by indentations formed at respective locations of said compartment.
- 25 7. A toothbrush according to Claim 1, wherein the manipulating mechanism comprises a control member, rotatable about a longitudinal axis of the toothbrush.

8. A toothbrush according to Claim 1, wherein the manipulating mechanism comprises a control member, slidable about a longitudinal axis of the toothbrush; a conversion mechanism being provided for translating linear motion into rotary motion in a plane normal to said longitudinal axis.
- 5 9. A toothbrush according to any one of Claims 7 or 8, wherein the control member is fixable so as to retain the bristle tuft bed at any respective position.
10. A toothbrush according to Claim 9, wherein the control member is a rod extending through a portion of the handle and rotateable about the longitudinal axis of the handle, where a surface of the control member is in tact with a corresponding surface of the handle, with either or both of said surfaces being formed with arresting members for securing the position of the control member, thereby retaining the bristle tuft bed at any respective position.
11. A toothbrush according to Claim 4, wherein the bristle tuft bed is made of a resilient material.
- 15 12. A toothbrush according to Claim 11, wherein edges of the bristle tuft bed are secured to respective edges of the frame member.
13. A toothbrush according to Claim 11, wherein the resilient member is articulated to an essentially rigid compartment dimensioned to accommodate the eccentric portion.
- 20 14. A toothbrush according to Claim 1, wherein the bristle tuft bed comprises at least two essentially rigid pads, each fitted with a bristle tuft array and being flexibly hinged to an adjoining pad; lateral edges of the pads being flexibly attached to corresponding periphery portions of the rigid frame.
15. A toothbrush according to Claim 1, wherein at the second position 25 toughness of the bristle tufts increases and at the third position toughness of the bristle tufts decreases.
16. A toothbrush according to Claim 1, wherein at the second position effective brushing area of the brush increases and at the third position effective brushing area of the brush decreases.

17. A toothbrush according to Claim 1, wherein at the second position the bristle tufts conjoin whereby their stiffness increases and at the third position the bristle tufts depart from one another giving rise to decreasing their stiffness.

18. A toothbrush comprising an elongate handle extending between a distal end and a proximal end, and a head portion fixed at said distal end and comprising a rigid frame member supporting a bristle tuft bed fitted with a plurality of bristle tufts and being successively deformable about a longitudinal axis thereof between concave and convex positions; and a manipulating mechanism for deforming said bristle tuft bed to acquire any of said positions.

19. A toothbrush according to Claim 18, wherein at a concave position of the bristle tuft bed the bristle tufts diverge thus reduce their toughness; and where at a convex position the bristle tufts converge thus increase their toughness; and where at a flat position of the bristle tuft bed said bristle tuft arrays extend essentially parallel to one another.

20. A toothbrush according to Claim 18, wherein at the second position the bristle tufts conjoin whereby their stiffness increases and at the third position the bristle tufts depart from one another giving rise to decreasing their stiffness.

21. A toothbrush according to Claim 18, wherein the manipulating mechanism is an eccentric mechanism fitted in the head portion and comprising a longitudinal actuator extending through a longitudinal axis of the toothbrush head with ends thereof pivotally fixed to the head portion, with an eccentric portion engageable with the bristle tuft bed for deforming it about said longitudinal axis.

22. A toothbrush comprising a handle and a head portion; said head portion comprising in turn a flexible bristle carrying bed made of a resilient material and being deformable by means of a manipulating mechanism so as to assume different stiffness positions obtained by deforming the bristle carrying bed between at least a concave position where the bristle tufts are less stiff, and a convex position where the bristle tufts are stiffer.

23. A toothbrush according to Claim 18, wherein at a concave position of the bristle tuft bed the bristle tufts diverge thus increase the effective brushing area;

– 14 –

and where at a convex position the bristle tufts converge thus decrease the effective brushing area; and where at a flat position of the bristle tuft bed said bristle tuft arrays extend essentially parallel to one another.

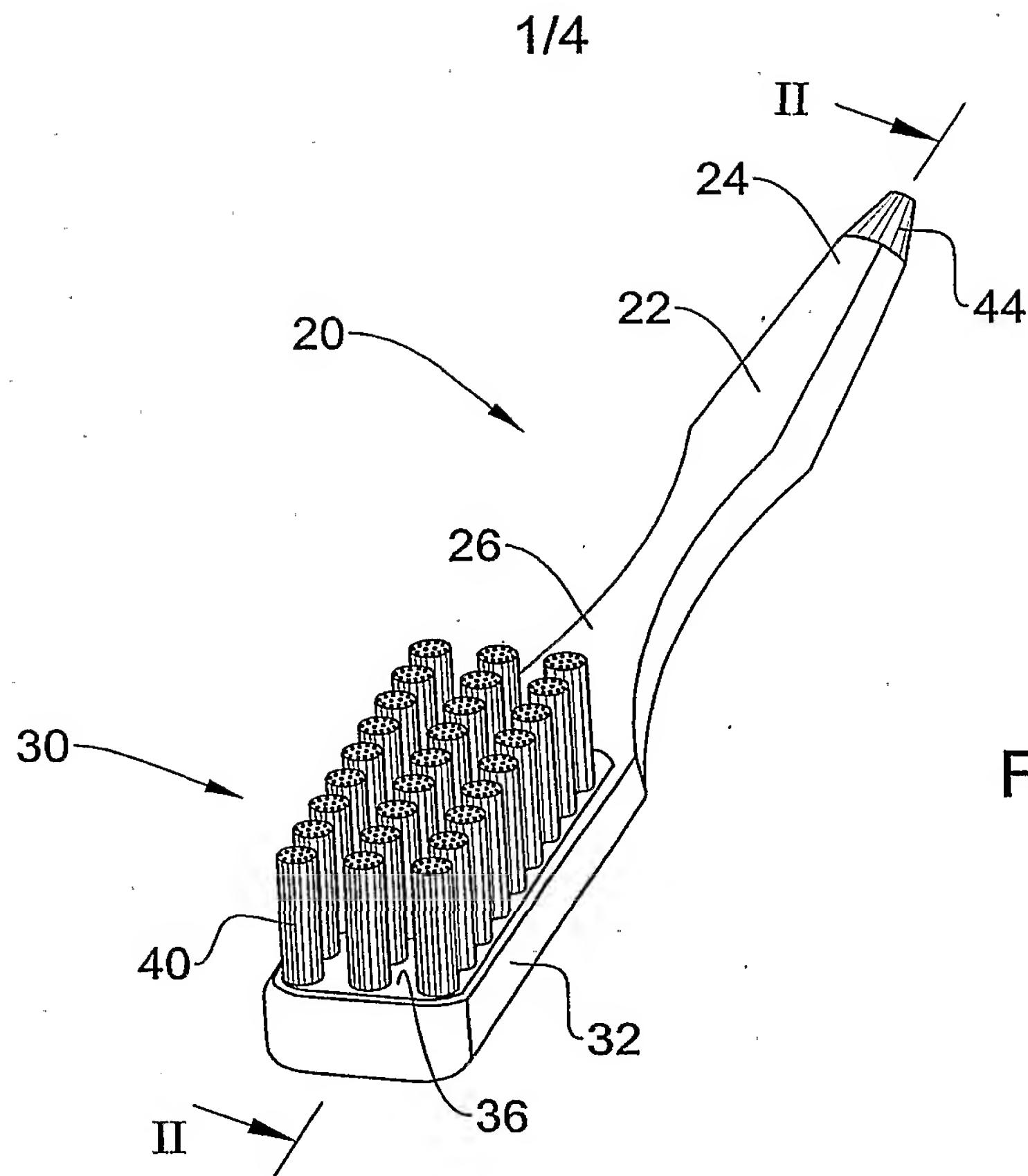


FIG. 1

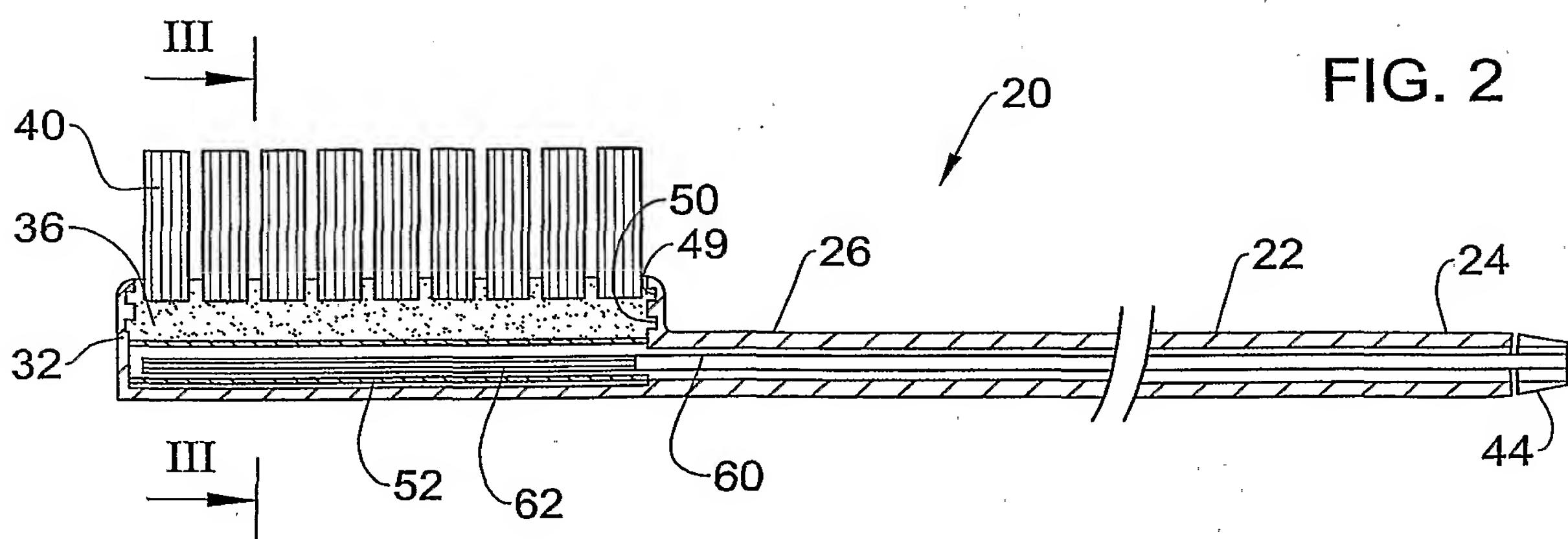


FIG. 2

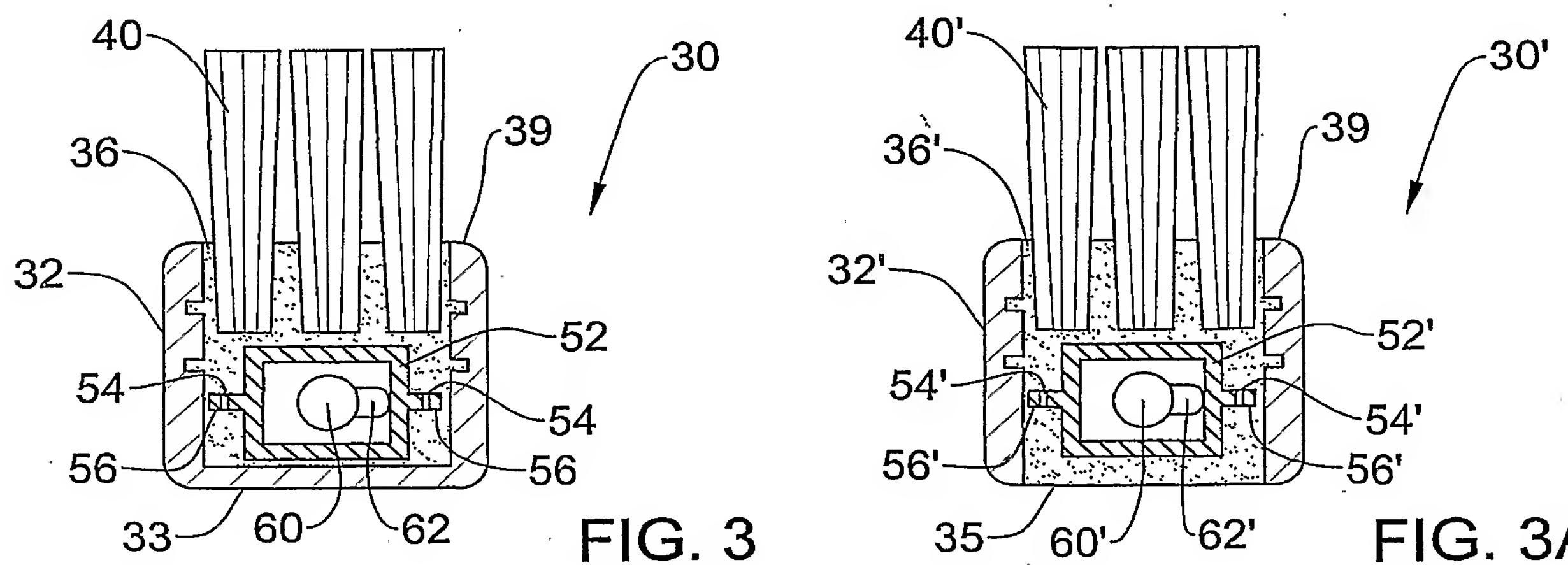


FIG. 3

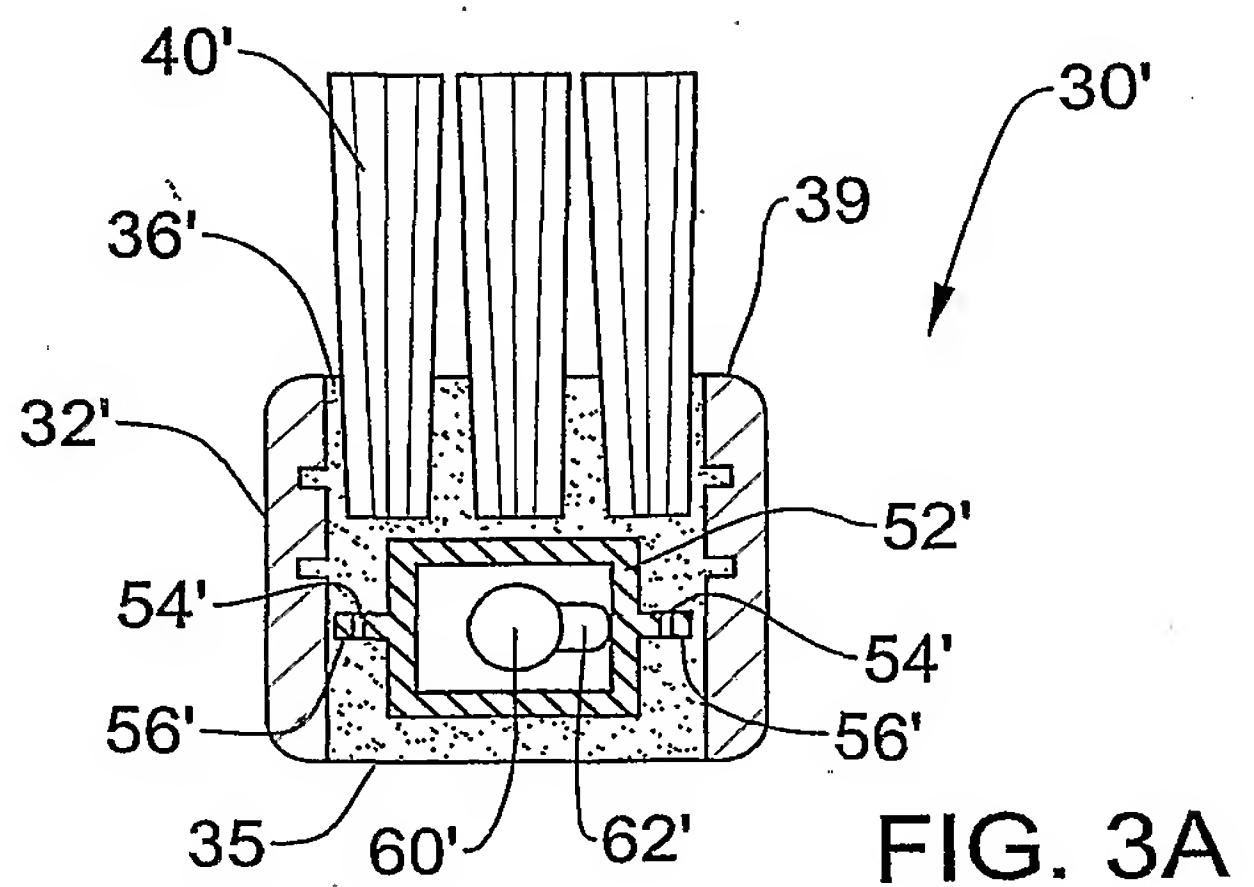


FIG. 3A

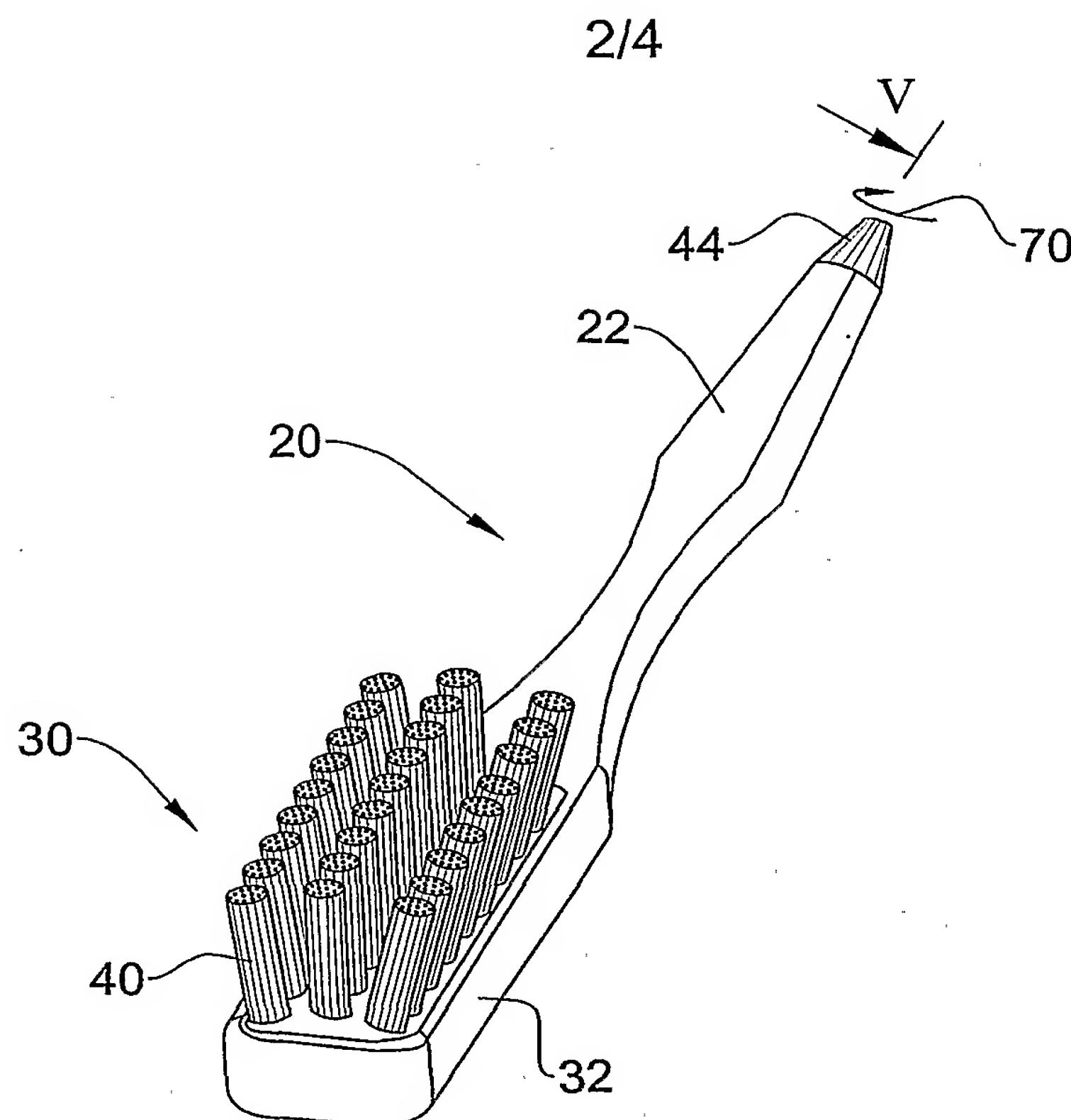
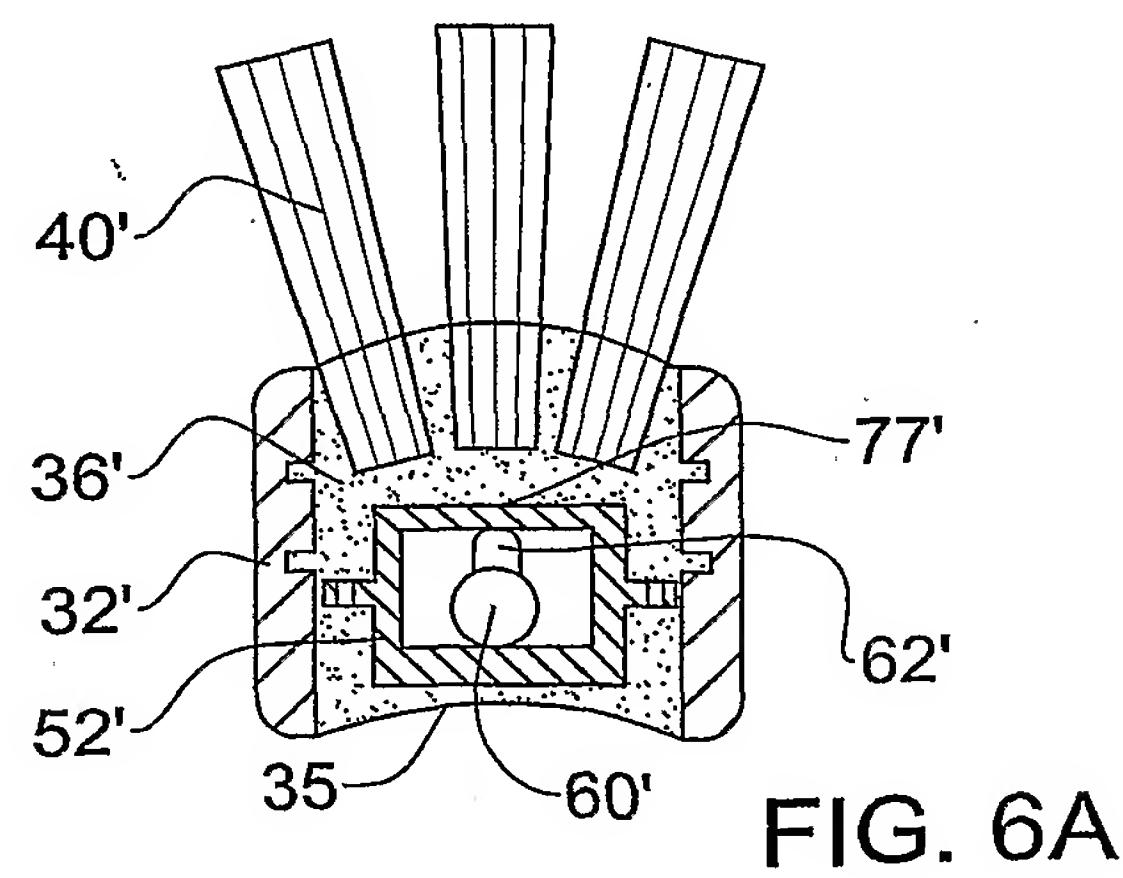
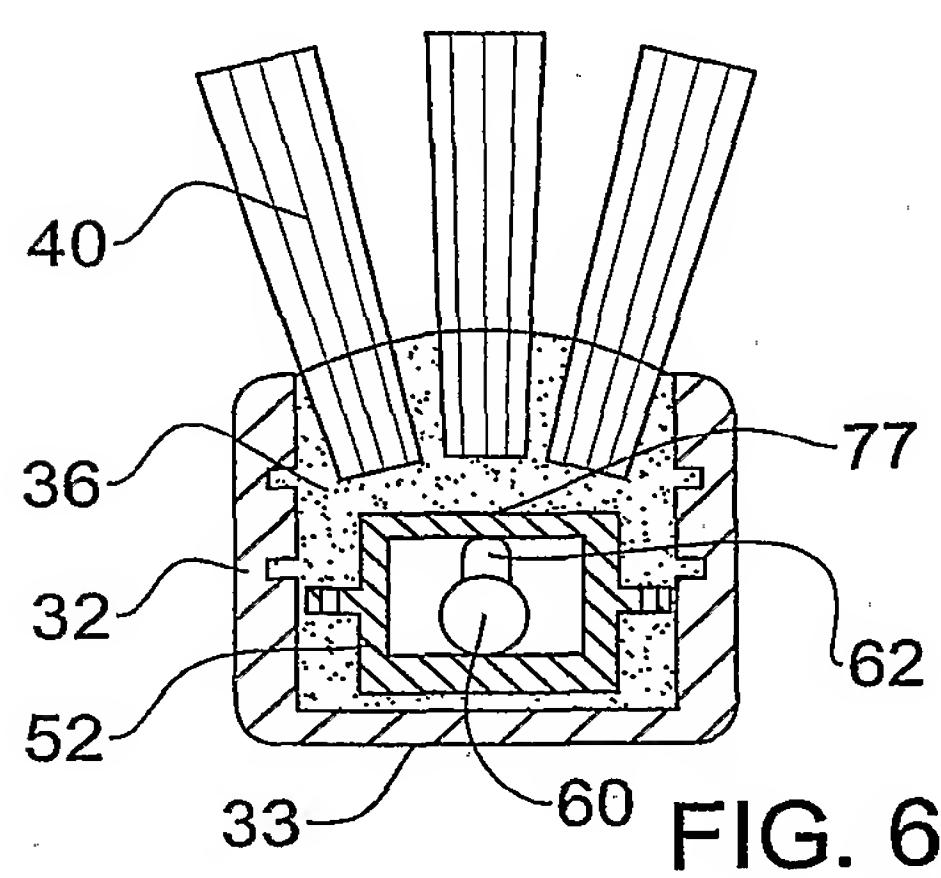
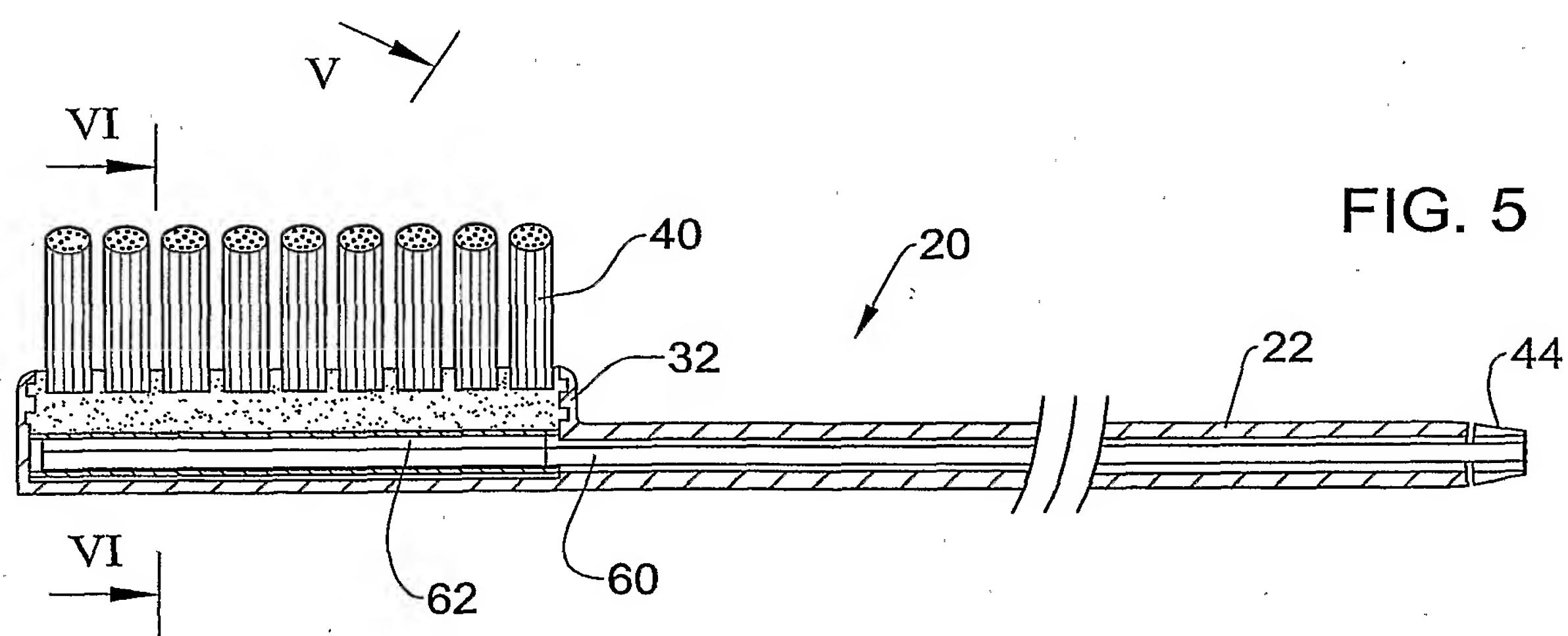
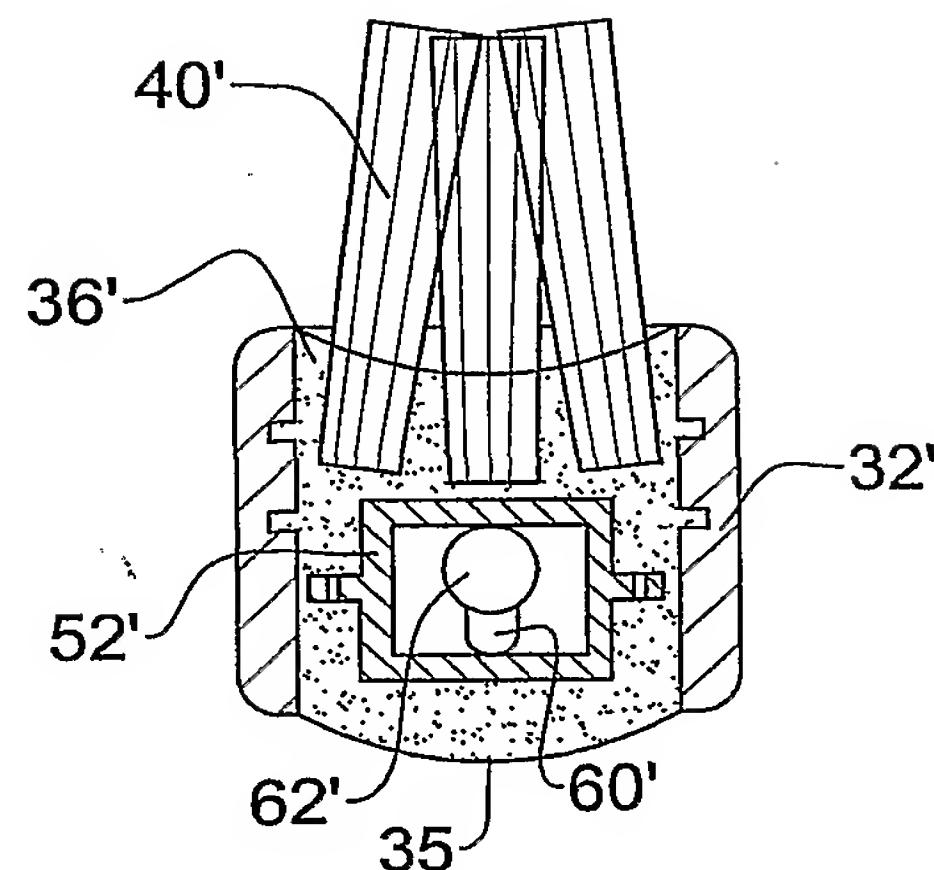
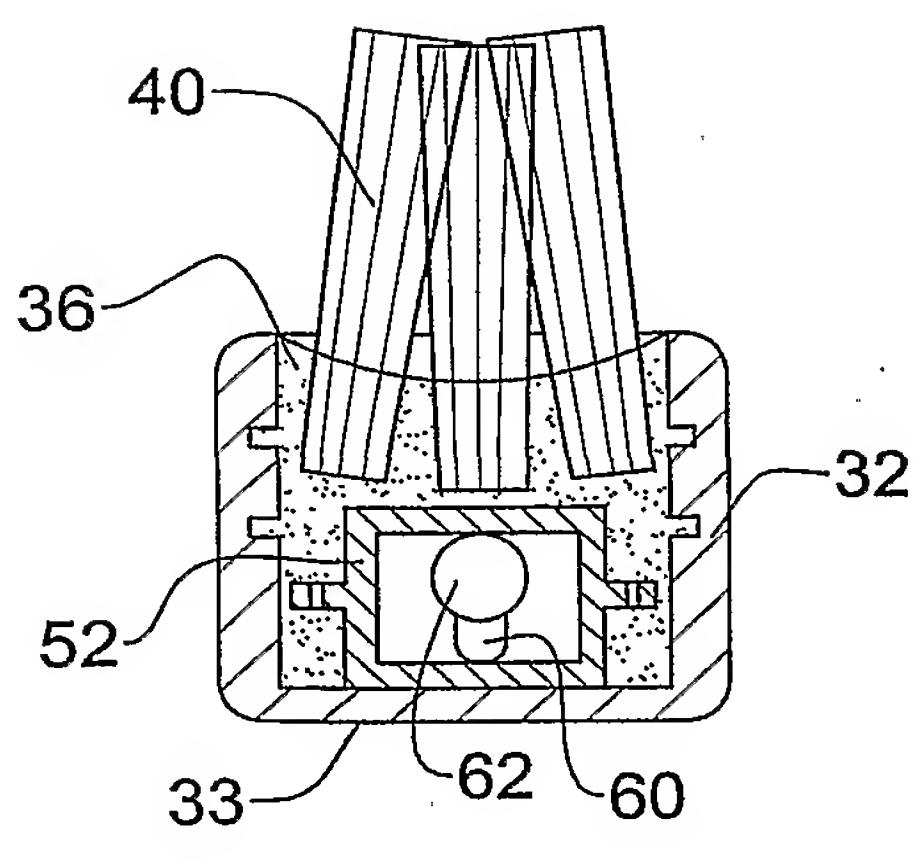
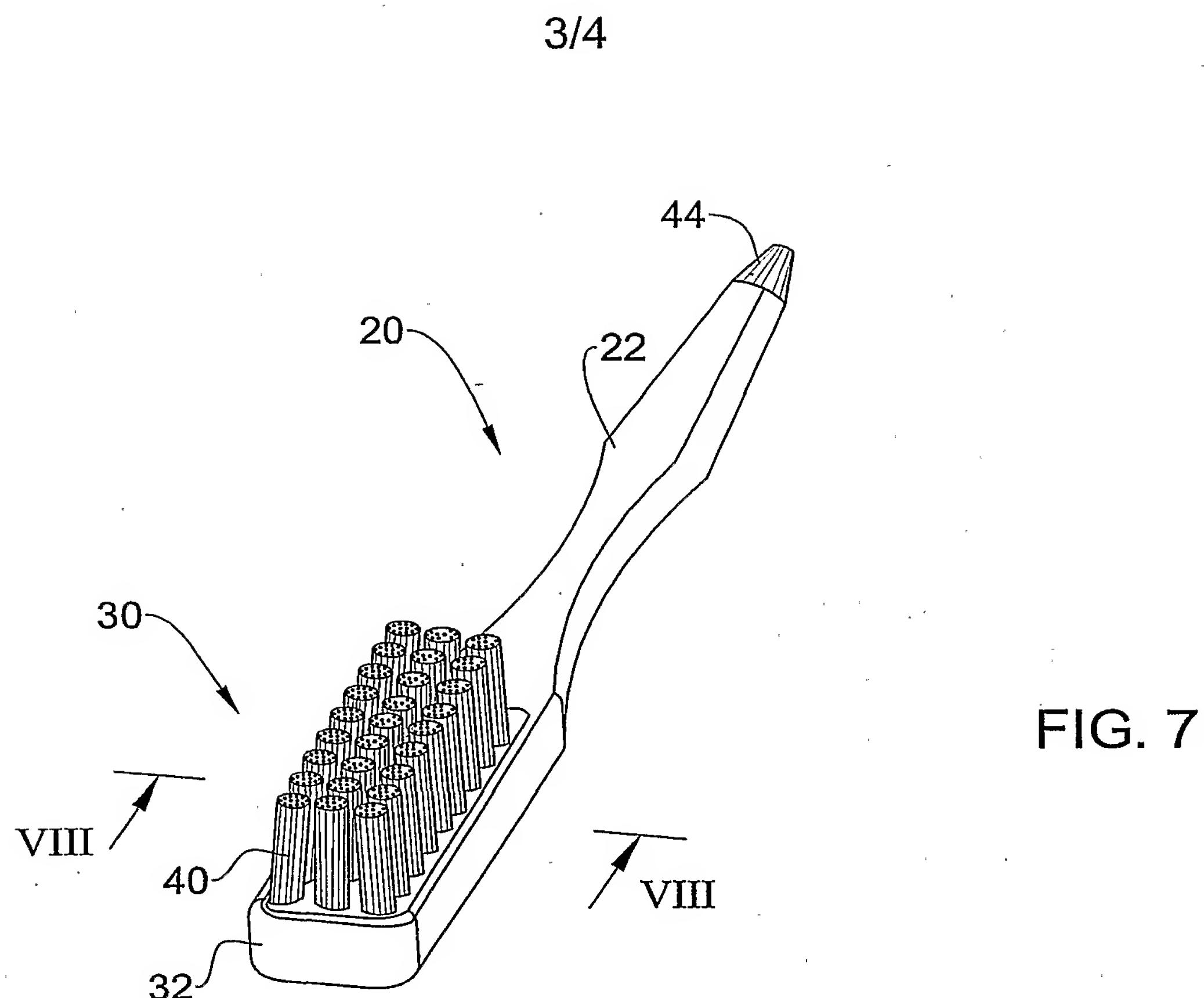
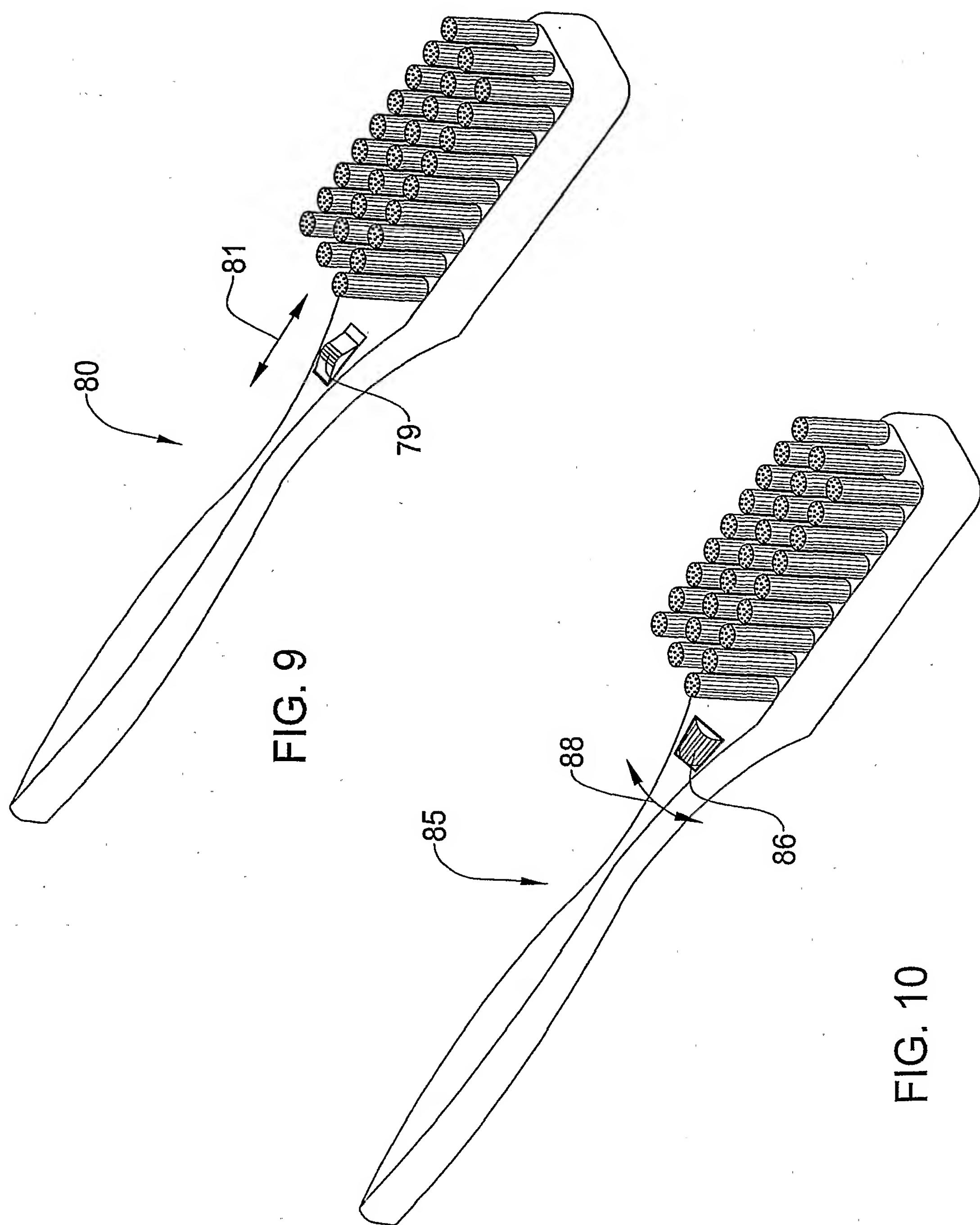


FIG. 4





4/4



## INTERNATIONAL SEARCH REPORT

International Application No

PCT/IL 02/00521

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 A46B3/20

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols).

IPC 7 A46B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 357 644 A (THERIAULT BERTRAND R) 25 October 1994 (1994-10-25) the whole document ----	1-23
A	US 5 435 032 A (MCDougall GREGORY J) 25 July 1995 (1995-07-25) the whole document ----	1-23
A	WO 97 14330 A (CORONET WERKE GMBH ;WEIHRAUCH GEORG (DE)) 24 April 1997 (1997-04-24) the whole document ----	1-23
A	DE 43 39 829 A (BROZIO GERARD) 7 April 1994 (1994-04-07) the whole document -----	1-23

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